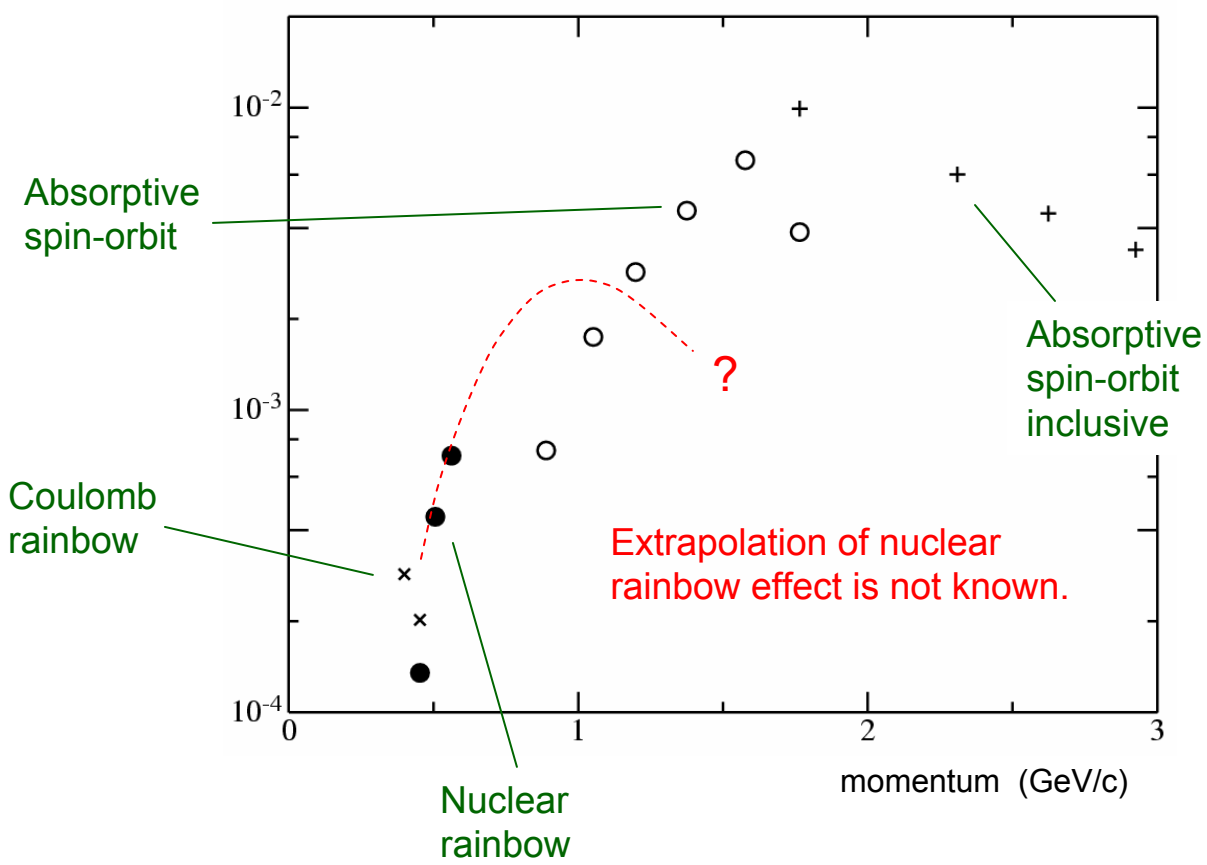
Deuteron Polarimeter Development Plans

EDM Collaboration meeting
February 20, 2004

Figure of merit = efficiency $\times \langle iT_{11} \rangle^2$
(based on elastic scattering from carbon)



Present ring designs apply near p = 0.6.

We need to know for selection of energy:

- shape of figure of merit curve near peak
- influence on shape of inclusive channels

Basic Plan:

- collect data at KVI
- design and build prototype
- test in COSY ring

Samples of inclusive data

cross section:

Wu, Chang, and Holmgren, PR C 19, 370
80 and 70 MeV deuteron projectile

deuteron breakup peak

p

evaporation peak

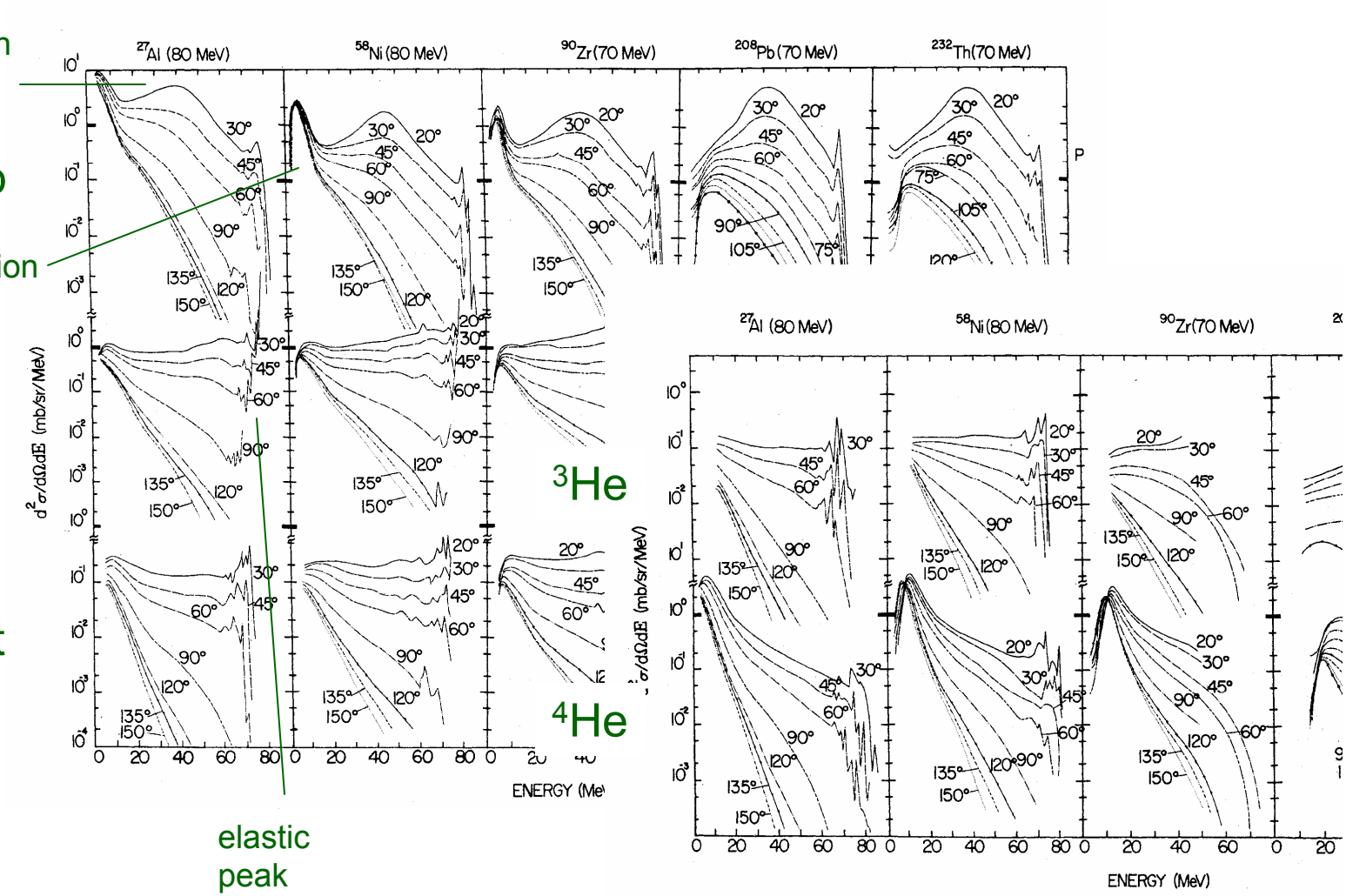
d

t

^{3}He

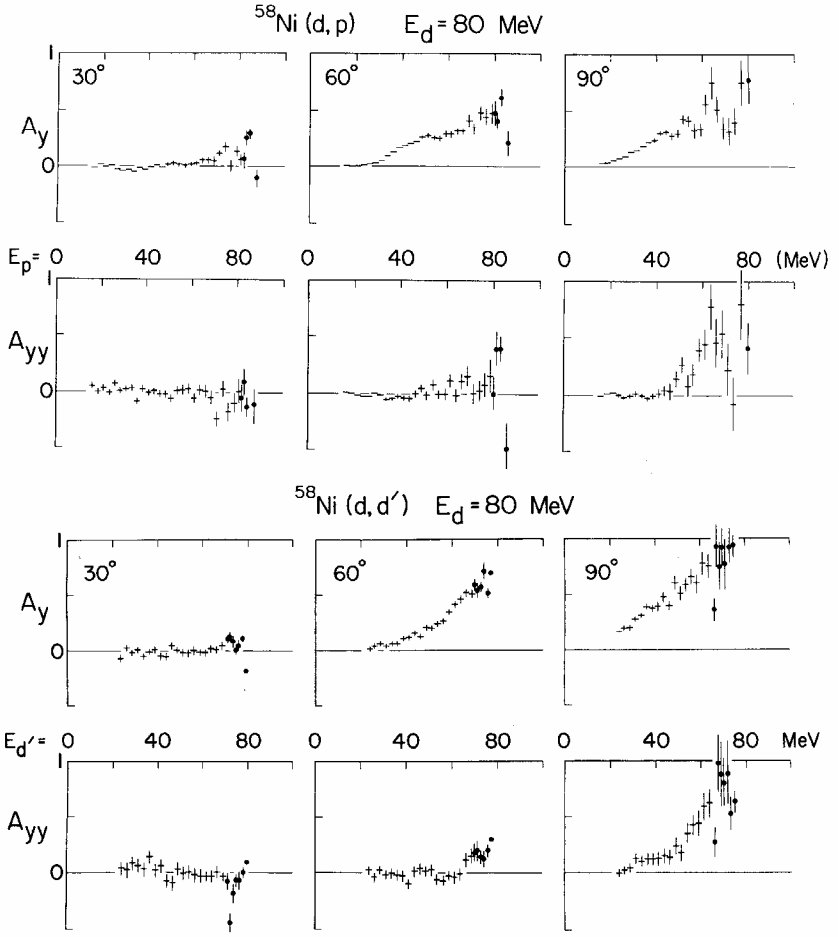
^{4}He

elastic peak



analyzing power:

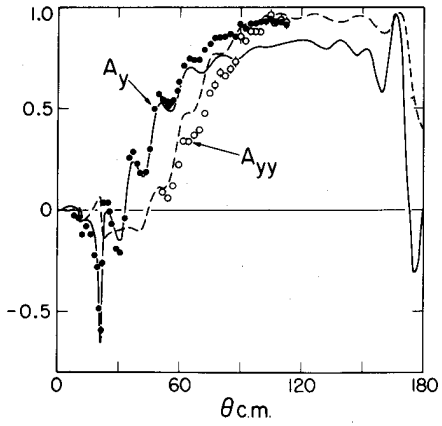
(see also Sakai et al., PR C 24, 2766)

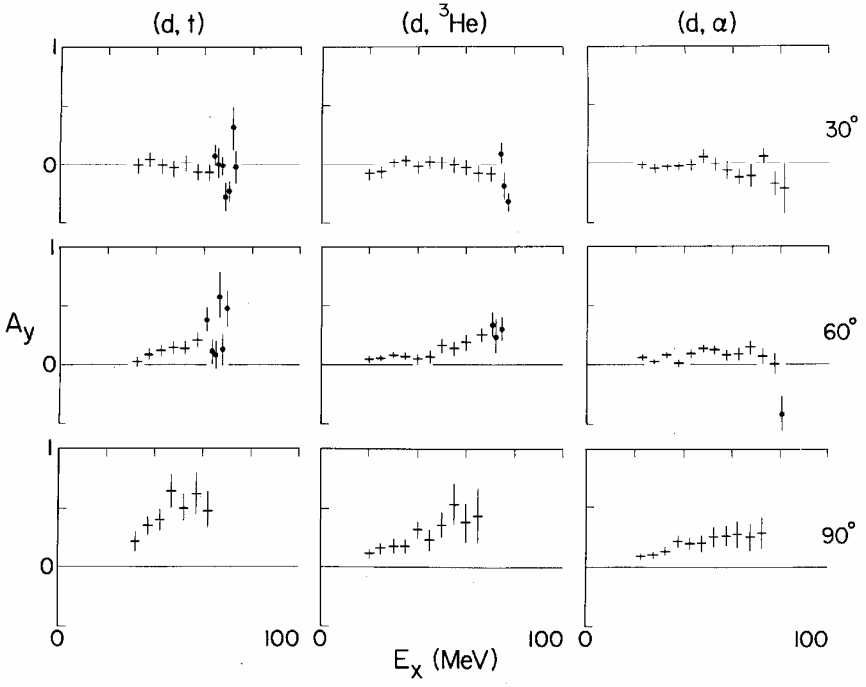


Optimize target thickness to consider:
- higher yield of thicker targets
- ranging out low-energy, low-A inclusives
- energy dependence as deuterons slow

example of elastic scattering

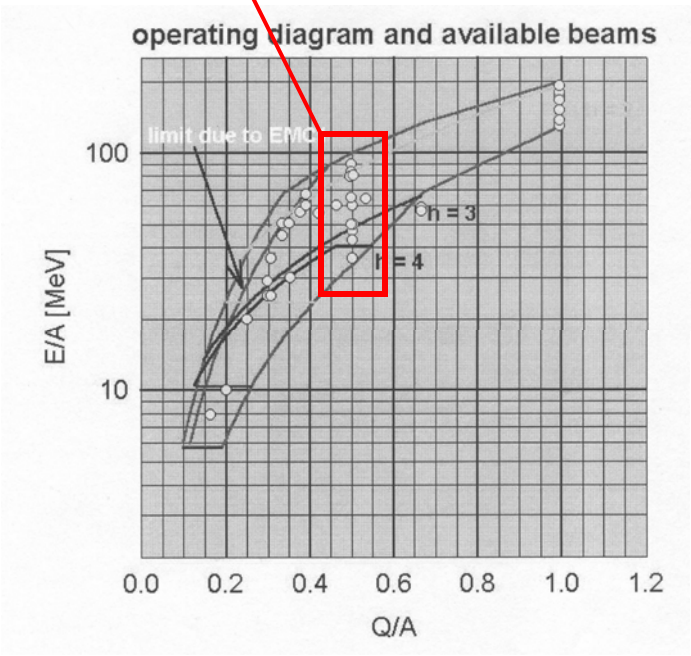
IUCF data

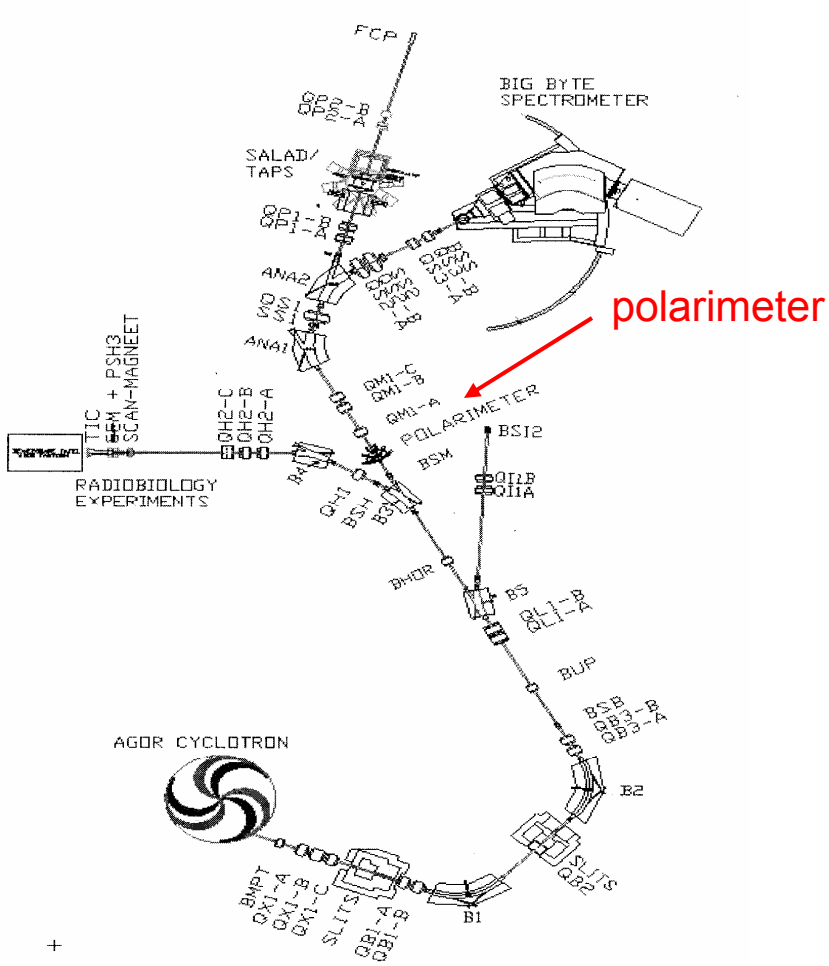




Running at the KVI

deuteron energies = 70 – 180 MeV



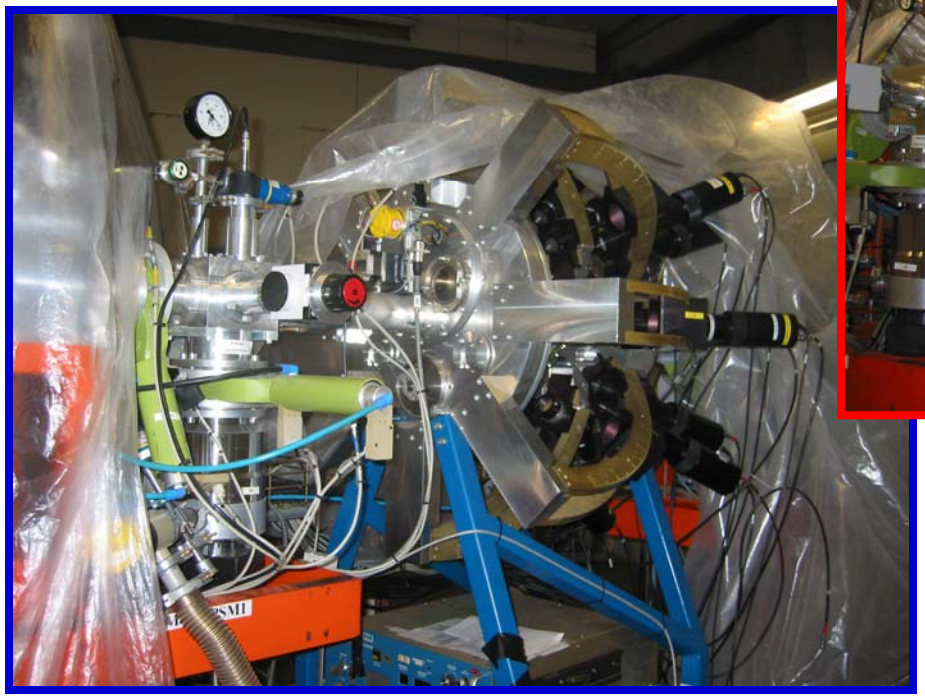


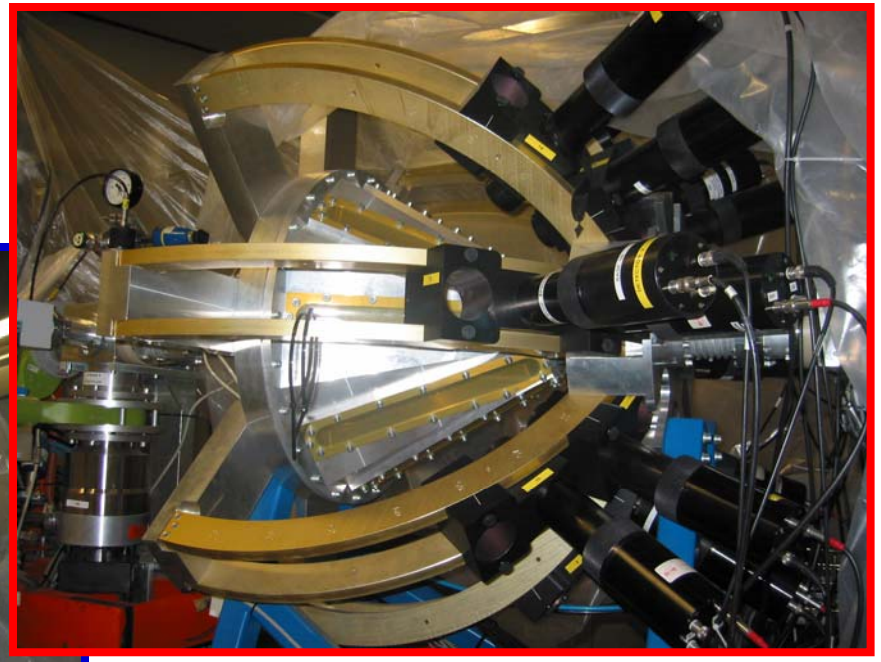
previously run polarized deuteron beams:

first choice: 180, 130, 86 MeV

others: 170, 160, 100 MeV

KVI polarimeter





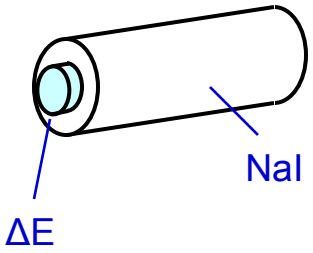
Polarimeter uses CH targets
to analyze polarized beams
using p+p and d+p scattering.

Deuteron analyzing powers
taken from RIKEN experiments
(Sekiguchi et al., PR C 65, 034003).

Phoswich detectors, run in
coincidence (p+p, d+p).

Issues: angle coverage,
resolution, thickness.

Way to address issues:
NaI detector with smaller
ΔE plastic scintillator
(may be available at IUCF)



KVI Plan

Use only two vector polarized deuteron beam states
$p_y = \pm 0.6$ with nominally no tensor
(most efficient way to run)

Aim for errors of $\delta A_y \sim 0.02$ in best energy bin (~ 2 MeV)
requires ~ 400,000 events/angle over all particles/energies

Measure angles in 3° steps, covering rising A_y
begin ~ 30° at 86 MeV and ~ 15° at 180 MeV
do some very large angles to check for maximal A_y

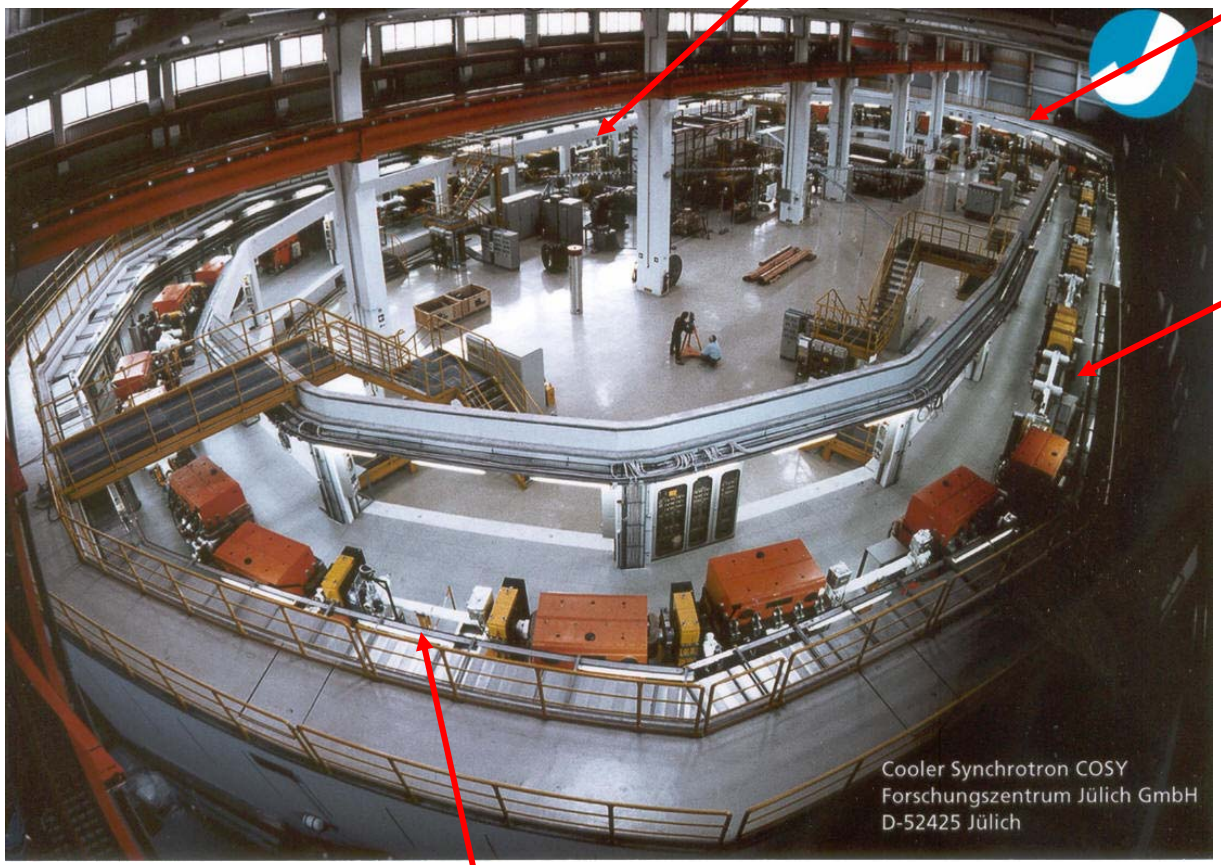
With data in hand,

build prototype

test/calibrate at COSY.

A Quick Look at COSY

A postcard from COSY construction



Low energy electron cooling is done here.

Beam injection from cyclotron happens here.

Experiments are installed in these straight sections, so space is tight.

Some arc space is available, but beam is dispersed and large.

Purpose:

- calibrate prototype
- examine beam-polarimeter interactions
- study systematic errors and sensitivity

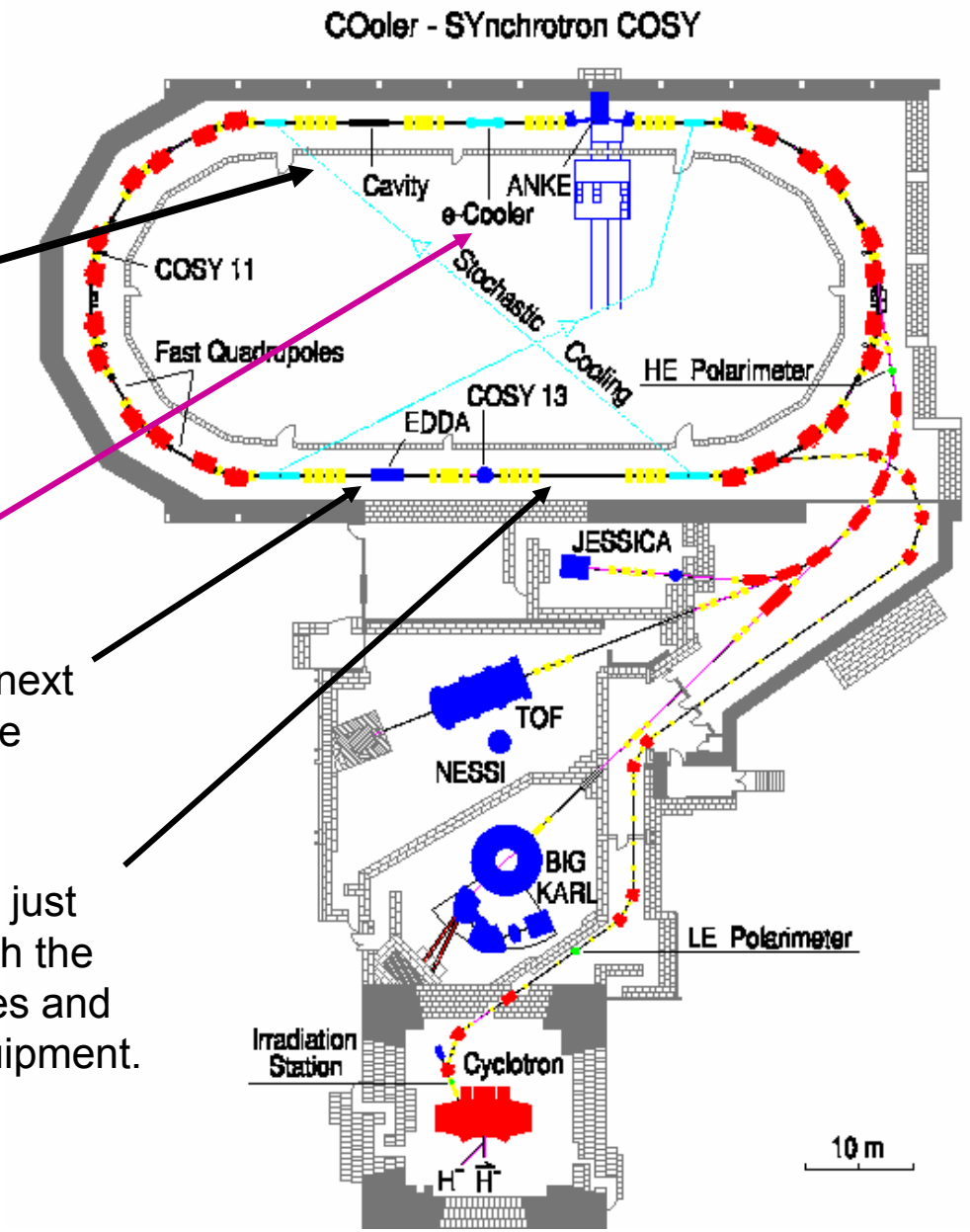
COSY now

Old RF cavity will come out, but is likely to be replaced by the WASA crystal ball. A decision is expected soon.

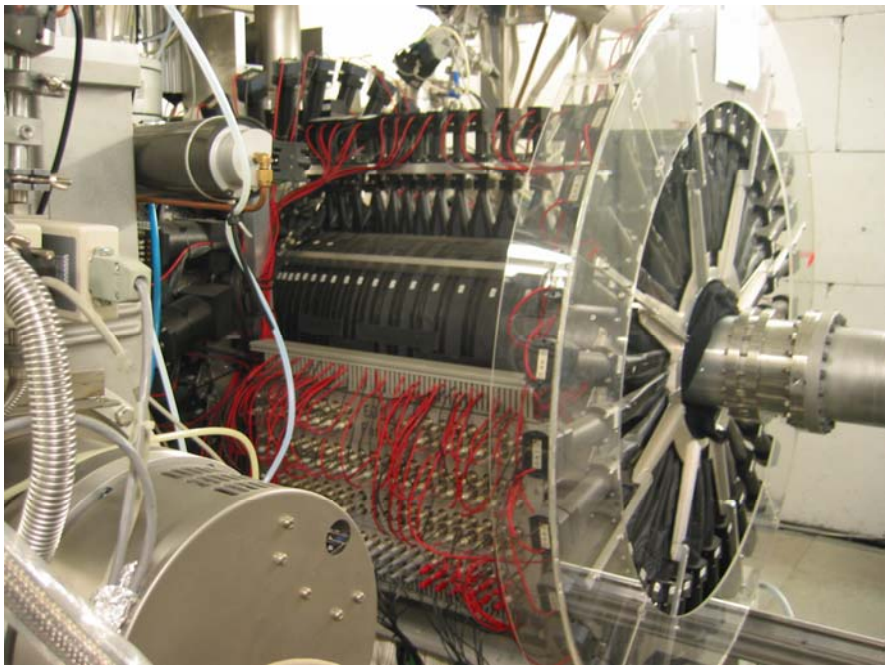
ANKE has gas target

The best opportunity may be next to EDDA, which happens to be the deuteron polarimeter.

This section is just about filled with the new RF cavities and diagnostic equipment.

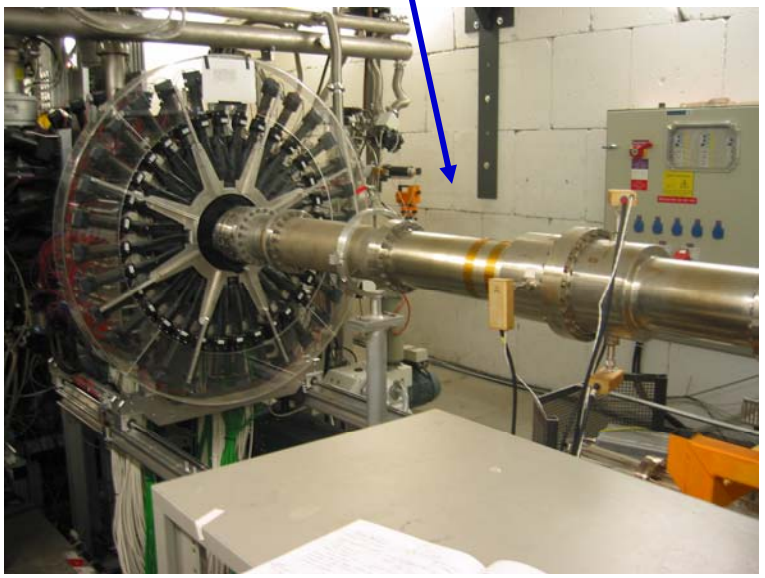


EDDA polarimeter (d+p)



We need at least 1 m of clear space to install the prototype polarimeter.

One possible place is next to the EDDA detector.



EDDA uses crossed scintillating strips for good angle defnition, indentifying d+p events using angles only.

EDDA uses a fiber target.